THURSDAY, JUNE 16, 1910.

THE FACE OF THE EARTH.

Das Antlitz der Erde. By Prof. E. Suess. Vol. iii. pt. ii. Pp. iv+789; 3 plates, 5 maps. (Vienna: F. Tempsky; Leipzig: G. Freytag, 1909.)

Namens und Sachregister für Sämtliche Bände. By Dr. L. Waagen. Pp. 158. (Vienna: F. Tempsky; Leipzig: G. Freytag, 1909.) Price, including index vol., 50 marks.

The Face of the Earth. Vol. IV. Translated by H. B. C. Sollas, under the direction of Prof. W. J. Sollas. Pp. viii+673. (Oxford: Clarendon Press, 1909.) Price 25*s*. net.

ALL geologists will join in hearty congratulations to Prof. Suess on the completion of his great work, the influence of which has been spreading steadily since the appearance of its first part in 1883. Prof. Suess's views were opposed to such cherished traditions that they were naturally at first regarded with suspicion; but *many* of his conclusions have been now generally accepted, and his illuminating suggestions have stimulated much fertile research. The last section of the work (vol. iii., part ii.) is accompanied by a series of most valuable maps and a detailed locality index of 158 pages, prepared by Dr. Lukas Waagen. The concluding part shows Prof. Suess's wide acquaintance with the whole literature of stratigraphical geology, which he interprets with characteristic insight and originality. The summary of recent geological work on various remote regions would alone ensure this volume a warm welcome from its usefulness as a work of reference, apart from its place as the completion of one of the standard works in geological literature.

The conclusion has been awaited in the hope that it would be largely devoted to a general summary of Prof. Suess's results and his explanation of the existing plan of the earth. This expectation has, however, not been fulfilled. This part includes the tenth to twenty-seventh chapters of the third volume, and thirteen of the eighteen chapters continue a revision of the mountain systems of the world, dealing with those of Europe, America, Africa, and Oceania. The remaining five chapters discuss various general problems, including the three zones of the earth's crust, which, from the chemical symbols of their leading constituents, Prof. Suess calls Nife, Sima, and Sal, the trend of mountain folds, isostacy, the process of igneous intrusion, the structure of the moon, and a final chapter on some lessons from the distribution of life. There is no attempt at a complete general theory of the distribution of land and water on the earth, as Prof. Suess apparently holds that none such is yet possible. He recognises on the earth several superposed plans, but makes no suggestion as to their causes. Thus the reason for the difference between the Atlantic and Pacific types of coast structure he describes as still unknown, and he leaves "to the future" (p. 724) the explanation of the great marine transgressions, the fundamental importance of which he was the first to appreciate correctly. The explanation that they are due to the shallowing of the ocean basins by the spheroidal recovery of the earth after periods of deformation is not mentioned, though it may once be vaguely alluded to.

The first impression made by a perusal of this volume is the greatness of the changes between it and its predecessors. Prof. Suess's essential principle that the face of the earth owes its expression to dimples and wrinkles due to the earth having shrivelled with age is maintained; but the view that all vertical movements are necessarily downward is abandoned. The ingenious explanations by which Prof. Suess endeavoured to explain away Darwin's evidence as to the vertical uplift of the coast of Chile after the earthquake of 1822 are resigned, in face of the well-established vertical uplifts along the western coasts of North America. Prof. Suess, however, does not admit uniform regional elevation, and he therefore necessarily rejects the principle of isostacy. He discusses this question in one of his final chapters, and expresses his strong distrust of mathematical evidence on such problems. Its uncertainty is illustrated by his proposal to alter the widely accepted conclusions by simply modifying the formula by which they were reached. Suess points out (p. 703) that the omission, as suggested by Faye, of the second factor in the formula used in deducing the weight of the earth's crust from gravity observations would remove the evidence obtained in some cases that the weight of mountains is compensated by a deficiency in material underneath. As the factor in question is a correction for the weight of the material between the point of observation and sea-level, its inclusion seems reasonable. Prof. Suess's further statement that deficiencies in mass beneath mountains "would be contradictory to all geological knowledge" (p. 708) is unexpected, as it is the weight of the geological evidence for the action of isostacy that has induced so many geologists to accept the mathematical arguments in its favour. Less stress is laid in this volume upon variations of the shore line in consequence of local disturbances of sea-level; and Prof. Suess remarks (p. 694) that there is no precise knowledge of the effect of continental attraction upon it. He also changes the meaning of the term batholite, which he proposed for masses of plutonic rocks injected into cavities due to radial contraction; he now attributes the formation of batholites to the replacement of the original rock by absorption and assimilation. Though most geologists are prepared to admit that igneous absorption takes place to some extent, many will probably hesitate before accepting it on so vast a scale.

Some modification was expected in the definition of the Atlantic and Pacific coast types, the establishment of which was one of the great contributions of Prof. Suess's earlier volumes. The Pacific coast type was originally characterised as bounded by mountain chains folded towards the ocean; this view has proved untenable without considerable modifications, and Prof. Suess now accepts (p. 577) the absence of mountain-making activity on the Atlantic coasts as the essential difference; he seems, however, disposed to regard the structural basis of this classification as less important than the petrographic; he retains the terms for Harker, Becke, and Prior's two petrographic regions, of which the Atlantic is characterised by igneous rocks rich in alkalies, and the Pacific by those rich in lime and magnesia. Both the characters of recent mountain formation and the chemical composition of the lavas can only be applied with numerous exceptions; and we cannot but think it would be regrettable if the great geographical truth in Suess's original view were abandoned, and his two terms retained with a meaning so changed and inappropriate as to be misleading.

Though no general theory is advanced in this volume, Prof. Suess gives in an appendix (pp. 783–5) his final classification of the lands of the earth. He arranges them in the following ten divisions:—

(1) Eurasia, including part of North America; (2) Laurentia; (3) Gondwanaland; (4) Australia, Oceania, and parts of Antarctica; (5) South America and the western mountains of North America; (6) the British Isles, excluding the southern counties, but including part of Norway and the mountains of the western Sahara; (7) the volcanic islands of the Atlantic type, with which are grouped some of the islands of the eastern Pacific, Indian and Southern Oceans; (8–10) the Cape Mountains, the north-western peninsula of New Guinea, and the Fiji Archipelago are each independent elements.

This classification, embodying the conclusions that have been reached by Prof. Suess after thirty years of most careful research, must command respectful consideration from all geographers, though objection may be taken to some parts of it.

The first seven chapters (Nos. x. to xvi.) describe the mountains of western Eurasia, of which the most important are referred to two groups, the Altaids, including the Hercynian Mountains of Bertrand, and the Alpids, formed by Cainozoic foldings in areas that had foundered in the frame of the older Altaids. The Caucasus are now transferred from the Alpine to the Altaid system. There are unquestionably important differences between the Alps and the Caucasus, but these two chains and the Pyrenees were all due to earth movements that probably had a connected origin, though they affected western earlier than eastern Europe. Thus the Pyrenees were folded at the end of the Eocene; the Alps in the Upper Miocene, and the Caucasus in post-Sarmatian times. No doubt the Caucasus has a foundation of older mountains; but so also have the Pyreness, which have indeed a more typical Altaid basis than the Caucasus.

No one can differ from Prof. Suess on mountain classification without great hesitation. But a classification which correlates the Caucasus with the hills of Devonshire instead of with the Pyrenees is obviously not intended for general geographical use. The geological evidence still seems consistent with the conclusion of Fournier, who, in his monograph on the Central Caucasus, reports "que la Caucase, par sa direction, par l'âge et le sens de son dernier plissement, par le parallélisme même des stades de sa formation, est le prolongement direct de la grande châine Alpine."

The African representatives of the Altaids include the Atlas Mountains, to the south of which is a mountain band composed of Archean rocks with a north to south strike. From this fact Prof. Suess identifies them as a section of the Caledonian mountains. In Scotland the general trend of the foliation in the gneiss and crystalline schists is not from north to south, which is the direction characteristic of the Archean rocks of equatorial and northern Africa; there seems no very convincing reason for correlating these mountains of the western Sahara with the British rather than with the African Archeans.

The discussion of the Eurasian Mountains closes with an especially valuable chapter, in which Prof. Suess traces the Altaid system through the Appalachians and across the United States as far west as Texas and the frontiers of Mexico. Then follow two chapters, one on the African fractures and the other on the Oceanids, the island festoons of Australasia. In dealing with Australia, Prof. Suess's most important proposal is its separation from Gondwanaland, on the ground that not enough is known of the intervening area to show their relations. The evidence, however, of the fossil flora and fauna of Australia seems conclusive of the former land connection of Australia and Gondwanaland.

Prof. Suess next discusses the western mountains of America, and traces the Asiatic structure into America through Alaska. He re-classifies the mountains of North America, and again, as with the correlation of the Caucasus, appears to attach undue weight to the early history and materials of the mountains in comparison with the movements to which they owe their existing forms and geographic importance. He divides the western mountains of North America into three groups. The eastern group is that of the Rocky Mountains, which Suess shows, by a masterly study of Alaska, belong to the Asiatic Structure. The westernmost group is the Mount St. Elias chain, which passes out into the Pacific through the Alexander Archipelago. All the mountains between the Rockies on the east and the chain of Mount St. Elias, and the Coast Range of California on the west he calls the Intermediate Mountains; they reach the Pacific coast in British Columbia and the northern part of the United States. On the strength, mainly, of these "Intermediate Mountains," Prof. Suess now maintains the essential unity in structure between North and South America, though of the four chief mountain elements in the former only the Intermediate Mountains occur in both. The view of the unity of the two Americas is based partly on these Intermediate Mountains and partly on the Andes, of which the low Archean Coast Range of California is regarded as the northernmost representative. Prof. Suess represents the Andes as formed by pressure from west to east, so that where the movement was not obstructed by the great mass of the Eastern Highlands of South America the Andean line projected eastward in two great loops, the northern Antilles in the West Indian area, and the "Southern Antilles," including Tierra del Fuego the South Shetlands, and Graham Land. In both these "Antilles" the Pacific is represented as having advanced into the Atlantic region. The writer once visited the West Indies to investigate this problem, and, in spite of the nature of the lavas, felt bound to reject the conclusion owing to the palæontological and tectonic evidence.

South America itself, according to Prof. Suess's interpretation, has a uniform structure without any trace of the earlier geographical plans which he admits in other continents. The mountains trending from north-west to south-east in the Argentine he explains as connected with the Andes, an opinion different from that of some Argentine geologists; and as it is conceded that the Sierra de Tandil does not belong to the Andes, there seems evidence for the existence of an older mountain system.

The English translation has been issued as vol. iv., without the plates, maps, appendices, and index, which are to follow. The translation shows evidence of haste, and it has missed the revision by several distinguished geologists of which the preceding volume had the benefit. Miss Sollas has done her part of the work well, as the translation reads easily; but in a work of such geographical importance it is a pity that the geographical terms were not more carefully revised. Thus the depressions on the oceanic floors known in German as "Rinnen" are translated as "channels" (p. 294), a term which connotes the idea of flow, so that the term "trench," recommended by the International Geographical Congress, is preferable. "Die Stauung der ersten Welle" (p. 438) is translated (p. 382) as "the stowing of the first wave," whatever that may mean. More serious objection can be taken to the translation of "Das Zwischen Gebirge," in which Prof. Suess includes all the mountains in Canada and the United States west of the Rockies with the exception of the Mount St. Elias chain, as the Intermediate "Range." The term range is so unsuitable to a vast area of mountain country, which includes many mountain ranges, that the translation cannot always adopt it; so when Prof. Suess says (p. 479), "Das Zwischengebirge in ein Meer von submeridionalen Zügen aufgelöst," the English version reads, "The Intermediate *Chain*, broken up into a sea of submeridional *ranges*."

As an illustration of the inconsistency in the translation of geographical terms, it may be remarked that Gebirge, Züg, and Kette are all sometimes translated as range; while Gebirge and Kette are also both sometimes translated as chain. British students will find the irregular treatment of place-names inconvenient and puzzling. Such variations as Brazilia and Brasilia are unimportant, though hardly to be expected in a work issued by a University Press; but many of the variations introduced are confusing. Thus, Prof. Suess speaks of the Sea of Ochot'sch, and calls some adjacent mountains the Ochitiden. The translation, by adopting Okhotsk (p. 328) for the sea and Ochotides for the mountains, obscures their connection; the latter name is once spelt Okhotides. The Yana of p. 331 is the Jana of p. 332; and the Chuchki Peninsula of p. 358 is the Chukchi of p. 377. The Chaja of Suess is sometimes repeated in that form (p. 334), sometimes as Khaja (p. 335), and as Chaya (p. 337). Kegyl (p. 334) is Kygyl on p. 339.

Many of the names in the translation appear in German forms, and are difficult to find in British atlases; thus the lake, which in the *Times* atlas appears as Yege—a reasonable transliteration—is spelt Eche or Esse. Yezo appears as Hokkaido, and Gilolo as Halmahera. The Vistula is mentioned thrice, but its identity is each time concealed by the retention of its German name, Weichsel; "from the Weichsel to Dakota" (p. 88) does not give much information to a student limited to British atlases or gazetteers. Further confusion is added by the differences between the text and the figures; thus Werchne in Fig. 28 is the Verkhne of the text, and Werchojanskij in the same figure occurs as Verkhoiansk in the text.

In the French edition the original technical terms are often quoted in brackets after the translation, and as that excellent precedent has not been followed it would be convenient if, in the index-volume, a list were given of Prof. Suess's geographical terms with the translations adopted.

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EXPLORATIONS OF INDIA.

The Gates of India. Being an Historical Narrative. By Colonel Sir Thomas Holdich K.C.M.G. Pp. xv+555. (London: Macmillan and Co., Ltd., 1910.) Price 10*s*. net.

THESE "Gates of India" are the gates beyond the Indus, the difficult tracks through which all the great historic invaders of the country made their way prior to the days of oceanic exploration. There are few men more competent to write about them than Sir Thomas Holdich, who knows them from the Pamirs to Makran, though he hardly refers to his own achievements as a geographer, but treats the matter mainly from the historic standpoint, beginning with the Medes and Persians, and ending with Pottinger and Burnes and their contemporaries.

For the purposes of review we may divide the book into three parts. The first part—a quarter of the whole—deals mainly with what may be called the conjectural period of Assyrian and Persian and Greek. The second part—another quarter—is taken up by the Arabs; here the observer, describing country as wonderful as it is inaccessible to ordinary people, keeps conjecture subordinate to facts of observation. The third part, occupying nearly half the book, reviews the explorations and adventures of the modern European period; here facts predominate, and the romance of the story is of an individual kind.

We propose to give precedence to the second or Arab period, as this part of the book is the most original and certainly the most novel.

Everyone, of course, knows in a general way that Arab merchants and slave-dealers went everywhere—their footprints have been left all over Africa; Algerian slave-hunters even raided the coasts of Iceland once upon a time—but amid the alarums and excursions of historians and archæologists intent on Macedonian and Mogul invaders and Buddhist monuments, most people nowadays need to be told that "the whole of the Indian north-west frontier was much traversed by and thoroughly well known to the Arab trader."

Sir Thomas Holdich has much to say about these